

The engineering study was completed by 36 study areas for 136 exchanges, representing 2.4% of all rural exchanges in NECA's common line pool. These companies split their subscriber lines into three geographic categories:

- Within the Central Dial Office Serving Area (CDOSA) - This is the area directly surrounding a central or remote dial office. Customers in this area may be served out of the central dial office on copper loops less than 18 kft. in length.
- Outside the Central Dial Office Serving Area (CDOSA) - This is the area beyond 18 kft. from the central or remote dial office but still broadband capable because distribution lines are within 18 kft. of a digital loop carrier (DLC) terminal.
- Isolated territory - This is the area where factors such as distance, sparse population, or difficult terrain make it uneconomical to upgrade loops to the DLC and copper configuration generally used to provide broadband capability for loops Outside the CDOSA.

The deployment study was completed by 88 study areas, for 108 exchanges, representing 1.9% of all rural exchanges in NECA's common line pool.

Based on the survey study results, NECA estimated the rural lines that will not be upgraded by 2002.

- Total Rural Lines not upgraded by 2002 3,333,290
  - This number is 35.0 % of the 9,520,279<sup>7</sup> rural lines in the Common Line Pool

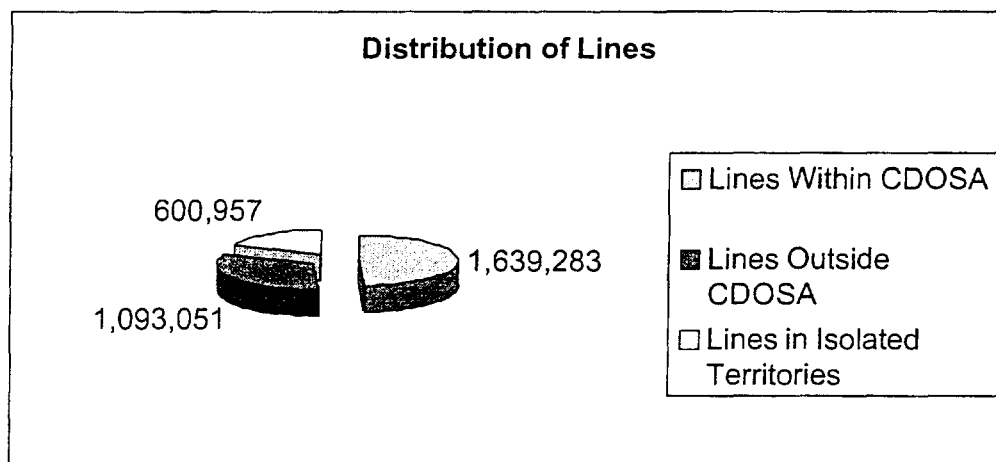
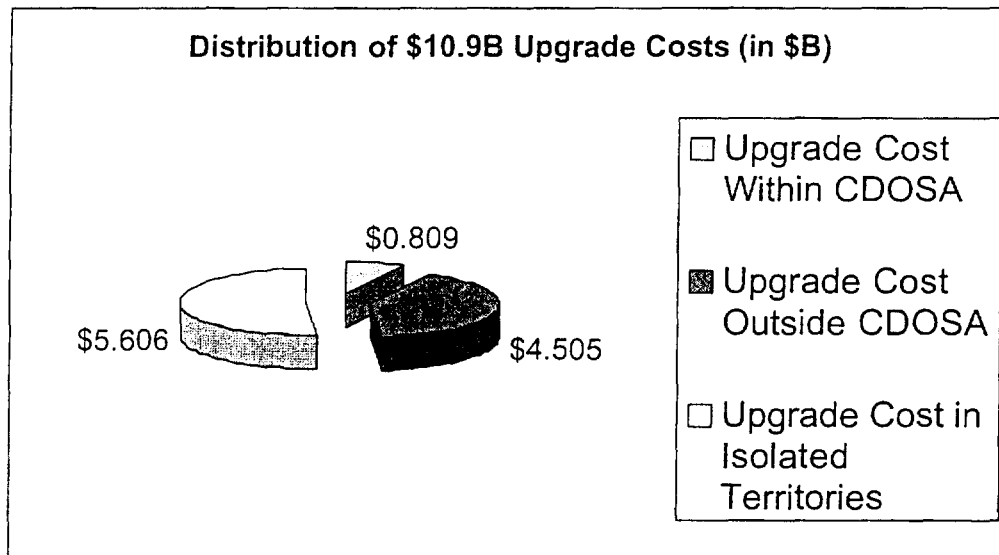
Matching these exchanges to those in the engineering study by line size and density, NECA estimated the cost of upgrading all these lines to broadband capability.

- Total Estimated Upgrade Cost<sup>8</sup> \$10.9B
  - Estimated cost within CDOSA 1,639,283@ \$493/line \$0.809B
  - Estimated cost outside CDOSA 1,093,051@ \$4,121 /line \$4.505B
  - Estimated cost of Isolated Territory 600,957 @ \$9,328/ line \$5.606B

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<sup>7</sup> Density and distance information were not available for 790 exchanges. Averages for the exchanges that did have detailed information were used to apportion the lines to the within CDOSA, outside CDO, and isolated territories categories.

<sup>8</sup> Cost per line based on average characteristics such as line size and customer density of rural exchanges not upgraded.



The engineering studies show that cable costs are by far the biggest cost component of network upgrades. Within the CDOSA they represent 63.6% of the cost upgrades and outside the CDOSA the percentage rises to 71.1%.

	Cable	Other <sup>9</sup>	DLC
Within CDOSA	63.6%	36.4%	0.0%
Outside CDOSA <sup>10</sup>	71.1%	4.0%	24.9%

<sup>9</sup> The category "Other" includes central office equipment within the CDOSA and miscellaneous costs (e.g. drops, NIDs, splicing, rights of way) for the outside CDOSA category.

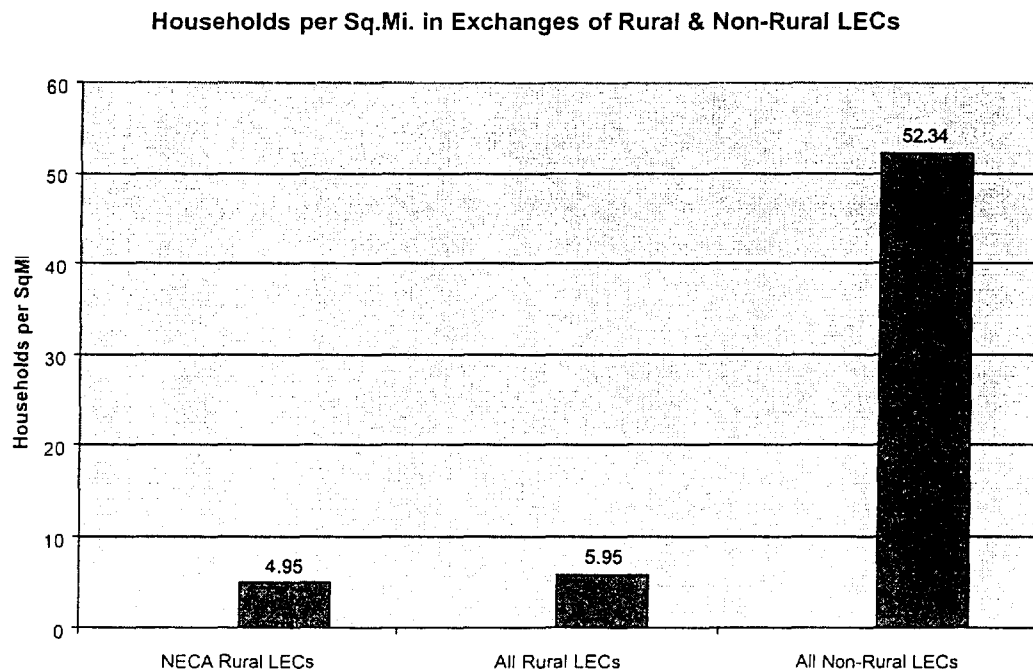
<sup>10</sup> Excludes DSL equipment (e.g. DSLAM's, etc.). This exclusion applies to both within and outside the CDOSA.

## Contrasts

The average values given so far only tell part of the story. Upgrade costs will differ enormously among rural telephone companies because of differences in size of customer bases, locations, age and condition of their networks. These graphs, tables, and individual facts are intended to show this diversity.

### 1. Households Per Square Mile – Rural vs. Non-Rural

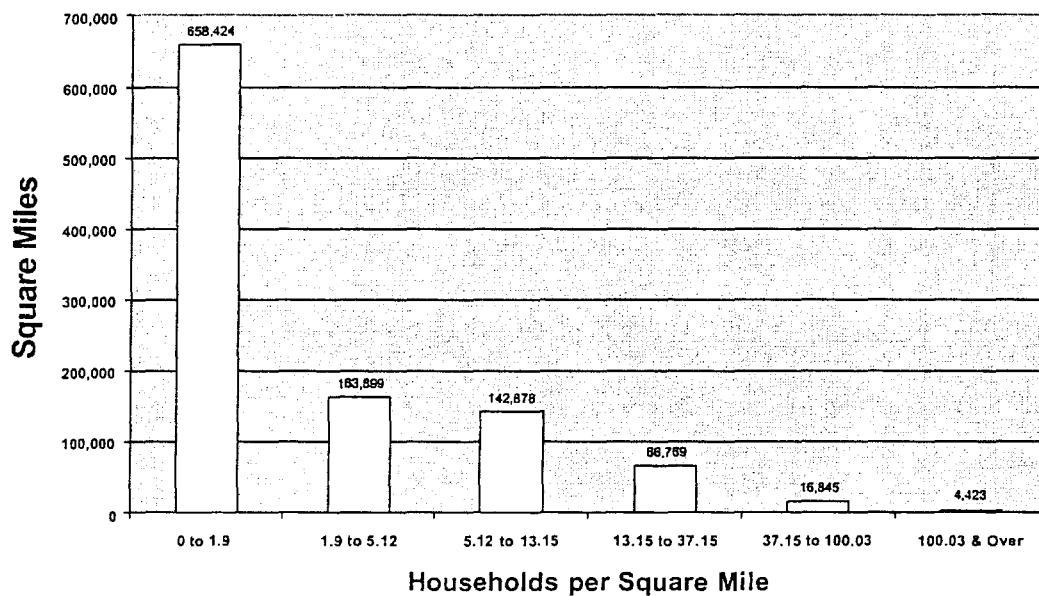
Using 1997 Claritas exchange boundary maps, plus census block maps with 1990 household counts, the average density of households in NECA's rural LEC exchanges (Telecom Act of 1996 Definition) is 4.95 per square mile. This is roughly the same household density as the 5.95 per square mile for all rural exchanges in the 48 contiguous states plus Hawaii. In comparison, the density for all non-rural exchanges is 52.34, a roughly ten to one difference.



## 2. Square Miles of Areas Served by Household Density Grouping

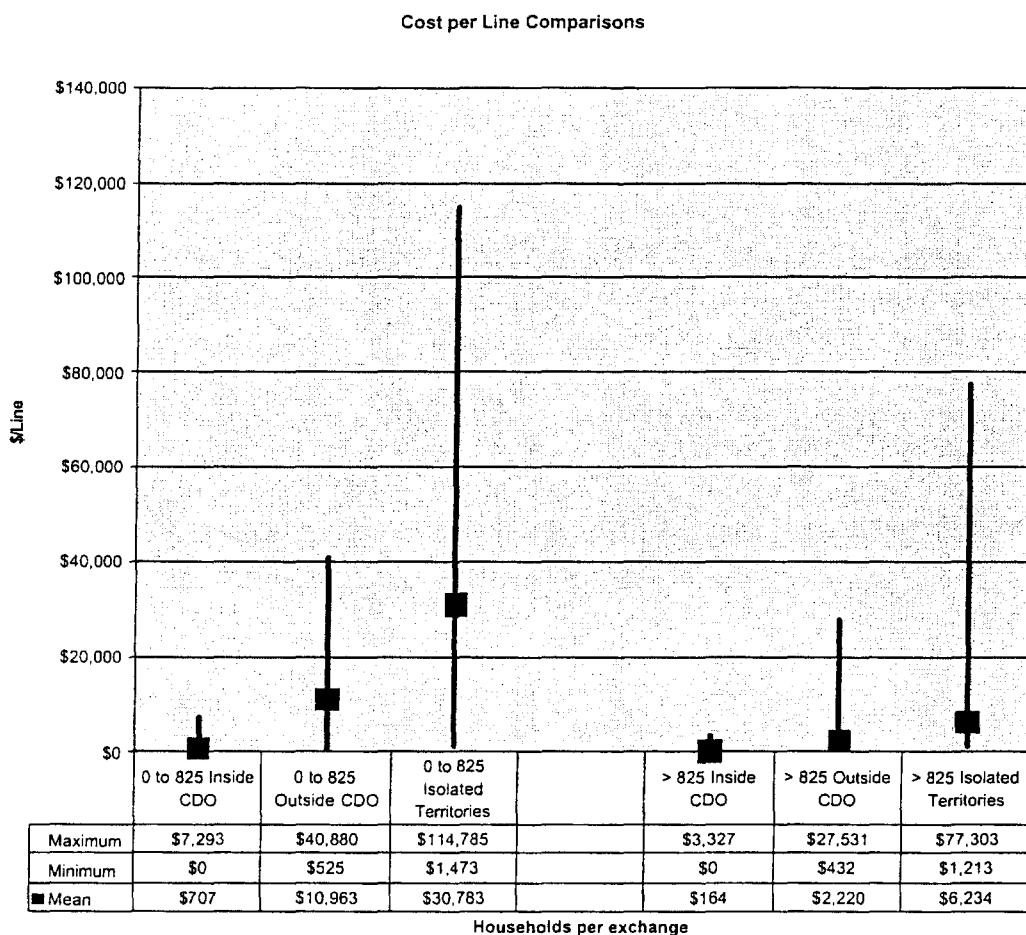
Areas served by all the exchanges of NECA's rural LEC's cover just over one-third of the land area of the 48 contiguous states plus Hawaii, 1,053,239 sq. miles out of 2,986,026 sq. miles. Of the NECA rural exchanges, the ones serving fewer than 2 households per sq. mile cover 658,424 sq. miles of territory. This is about 62% of the serving territory of all rural NECA exchanges.

**Areas Served by Exchanges of NECA Rural LECs**



### 3. Upgrade Costs by Category Graph

The effects of low density and long loops in rural areas show clearly in the average cost of broadband upgrades. Data from the engineering study show that upgrade cost per line declines, on average, as lines per exchange increase and distance from the central dial office decreases. The tick marks on the following graph show these average declines for two exchange size groupings: exchanges with fewer than 825 households and exchanges with more than 825 households.



The graph also portrays the striking cost variability in upgrading exchanges that is not captured in average profiles. The tips of the spikes show the high and low values for a particular grouping. Within relatively uniform categories, the range of the upgrade costs per line almost completely overshadows the average, especially for the 0-825 household category.

#### 4. Other observations:

Variability is a persistent theme in this study.

- Average customers per Digital Loop Carrier (DLC) range from 3 to 290.
- Minimum customers per DLC range from 1 to 120.
- 47 of 136 exchanges did not require an upgrade to the Outside Plant Network within the CDOSA.

Unusual expenses were also reported

- Payments for crop damage
- Archaeological surveys
- Lack of AC power

The timing of upgrades is strongly related to the age of the plant. The engineering study showed that an upgrade occurs when outside cable is at least 12-years old. Typically the age is 20-years at when the outside cable is replaced. This explains the delays in upgrading networks.

#### **Additional Observations**

- This study will be an ongoing one to keep abreast of the progress and cost of deploying broadband capability in NECA's Common Line pool.
  - NECA will continue to add new exchanges to its sample to ensure that the results are fully representative of rural wire centers in NECA's Common Line pool.
  - Isolated territory estimates are the opinions of company experts. They are not derived from actual upgrades or planned upgrades based on detailed cost analysis. The experts did not base their estimates on a predefined technology. These estimates are subject to continuing review.

## APPENDIX

### Study Methodology

- The study covers rural study areas that belong to NECA's Common Line Pool excluding the non-rural Common Line LECs - Puerto Rico Telephone, Roseville Telephone, Anchorage Telephone, and North State Telephone (NC).
- The total cost of upgrading rural study area lines within NECA's Common Line pool to broadband capability is based on the data collected from two complementary data requests:
  - Survey I asked for detailed cost information from exchanges with completed or planned network upgrades.
    - Responses have been received so far from 36 companies for 136 of their exchanges. This information was used to calculate Average Estimated Per Line Network Upgrade Cost
    - These LECs were asked to identify the costs of upgrading their plant to be broadband capable.
    - For the purposes of this study, broadband capability means a line speed in excess of 200 Kbps both in the upstream and downstream directions.
    - Survey I assumes that rural LECs will implement CSAs in preparation for providing broadband via DSL technology.
  - Survey II asked for the status of outside plant network upgrades from a sample of study areas that were not part of the Survey I sample
    - To date, responses have been received from 88 companies for 108 exchanges. This information was used to calculate the cost of Total Rural Lines not yet upgraded.
- Incremental Cost for upgrading isolated territory is based on responses received from both surveys which indicate that 18.0% of upgraded lines (5.7% in exchanges not upgraded, and 12.3% in exchanges that have had major upgrades) are in isolated territory, and are estimated to cost 2.80 times more to upgrade than lines upgraded outside the CDOSA.
- Isolated territory is defined as the area where factors such as distance, sparse population, or difficult terrain make it uneconomical to upgrade loops to the DLC and copper configuration generally used to provide broadband capability for loops Outside the CDOSA.

- Existence of Isolated Territory is attributed to factors such as low line density or terrain, which could make network upgrades prohibitively expensive for exchanges.
- For two different line size groupings, sample LECs were assigned to one of nine strata based on population density and average customer distance from the wire center. Costs from the sample were then calculated for each of the nine strata and then applied to the universe of rural LECs in the Common Line pool.